

Therapeutic and financial toxicity in the management of cancer in some tertiary health facilities

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Abstract

Cancer remains a significant public health concern globally, with treatment-associated financial and therapeutic toxicity posing major challenges, particularly in low- and middle-income countries. This study evaluates the therapeutic and financial burdens of cancer care among patients receiving treatment at two tertiary health institutions in Jos, Nigeria. A retrospective cross-sectional review of medical records was conducted over a five-year period (March 2018 to July 2023) at Jos University Teaching Hospital (JUTH) and Bingham University Teaching Hospital (BhUTH). Data were analyzed using descriptive statistics and WHO prescribing indicators while, therapeutic and financial toxicity were assessed based on cancer type, drug regimens, and treatment-related side effects. Of the 228 patients studied, females constituted the majority (77.6%), with cervical (28.1%) and breast cancer (24.1%) being the most prevalent. Polypharmacy and high use of injectables were common. Frequently prescribed drugs included cisplatin, paclitaxel, and doxorubicin, all associated with significant side effects such as myelosuppression, nausea, and alopecia. Financial analysis revealed mean chemotherapy costs of ₦732,585 (JUTH) and ₦481,989 (BhUTH), with considerable variation depending on treatment type and duration. Most patients bore out-of-pocket expenses, underscoring limited insurance coverage and significant financial burden. Cancer treatment in the studied institutions is characterized by substantial therapeutic and financial toxicity. The need for affordable care, improved insurance coverage, and safer therapeutic options is critical to enhance cancer care outcomes in resource-limited settings.

Keywords: Anticancer; Chemotherapy; Medical cost; Oncology; Toxicity; Jos-Nigeria

1. Introduction

Financial toxicity generally refers to the damaging impact of the financial burden associated with cancer management on the patients, the family members and the society at large [1]. Although recent advances in cancer management are encouraging and cheering but this development becomes irrelevant when patients cannot afford the cost of the care. Affordability therefore has become the rate limiting step that determines the prognosis of cancer care [2]. The various advances and treatment options in the management of cancers such as immunotherapy, hormonal therapy, use of targeted agents, radiation therapy and surgery have greatly improved cancer treatment outcomes. However, these treatment options also come with the challenge of therapeutic toxicities [3]. The financial toxicity will however provide an overarching influence over the therapeutic toxicity. Cancer is a non-communicable disease reputed as a leading cause of death globally [4]. It constitutes one of the greatest global health challenges to mankind especially those less than the age of eighty-five years old [5]. The challenge posed by this disease can be minimized by early detection and management [6]. Drastic reduction of cancer mortality depends on prevention and early treatment strategies [7]. The

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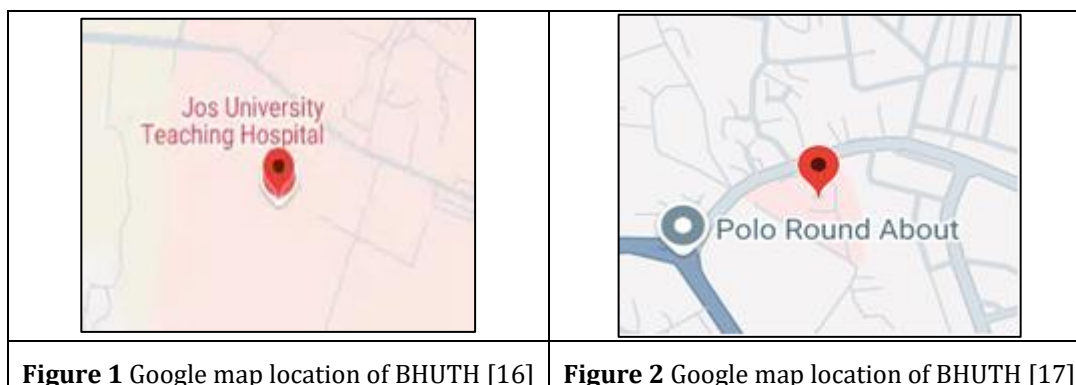
most common cancer types are breast cancer, cervical cancer, prostate cancer and colon cancer and anorectal cancer. Medications for the treatment of cancers especially the new ones are expensive and affordability is a key challenge in resource limited countries [8]. A recent study revealed that oncology drugs are more expensive in low-income countries than in high income countries [9]. The ready availability of the latest and more effective chemotherapeutic agents is challenging especially in developing countries [10].

There are medicines for the management of different forms of cancers [11] and new ones with better activity are entering the market from day to day. Most developing countries don't have a program that pays the bill for cancer patients. The resource challenged citizens of low-income countries cannot afford the anticancer drugs. Towards the realization of the goal of sustainable affordability and availability of anticancer medicines, the World Health Organization (WHO) provided a list of essential medicines including anticancer drugs. The list assists countries in making a selection of cost-effective, safe and therapeutically effective medicines [12]. The low-income countries are also plagued with lack of insurance program for the cancer patients thus limiting their access to the needed medicines [13]. The pharmaceutical sector in the developing countries is bedeviled with poor inventory control and management of medicines thus worsening the challenges faced by cancer patients [14]. In cancer chemotherapy, the drugs are required for a long duration of time and this reality contributes to the overall cost of care for this category of patients [15]. This study examined the financial and the therapeutic toxicity of cancer diseases in two tertiary health institutions in University Teaching Hospital (JUTH) and Bingham University Teaching Hospital (BhUTH) Jos Nigeria.

2. Materials and Methods

2.1. Study Design and Site

A retrospective, cross-sectional study that captured four years hospital records (clinic register/admission records of both male and female in and out-patients who had been diagnosed of cancer and have been receiving treatment from Jos University Teaching Hospital (JUTH) and Bingham University Teaching Hospital (BhUTH) Jos Nigeria from March 2018 to July 2023.



2.2. Inclusion Criteria

Out-patients and in-patients (males and females) irrespective of ages who had been diagnosed of cancer and receiving treatment from JUTH and BhUTH within the past five year.

2.3. Exclusion Criteria

Patients not receiving cancer treatment in JUTH and BhUTH within the study period.

2.4. Financial Burden Considerations

2.4.1. Direct cost

Include hospital bills, medication costs, laboratory tests and imaging studies

2.4.2. Indirect costs

Include loss of income due to inability to work during treatment and cost associated with transportation to healthcare facilities

2.4.3. Insurance coverage

Many patients may not have adequate health insurance coverage, leading to higher out-of-pocket expenses

2.4.4. Socioeconomic factors

Lower socioeconomic status can exacerbate the financial burden, as many patients may have limited access to resources for treatment

2.5. Data Analysis

The data collected were analyzed using SPSS version 21 (IBM Corporation, Armonk, NY). The demographic and clinical characteristics, as well as the utilization of anticancer drugs and its indicators were analyzed using descriptive statistics; mean, standard deviation and frequency. Prescription pattern of anticancer medicines was determined using WHO core prescribing indicators for the number of prescriptions with polypharmacy, percent of prescriptions with injectables, percent of drugs prescribed with generic and brand names, percentage of antibiotics encountered.

3. Results and Discussion

Table 1 Demographic characteristics (n=228)

Age group	Frequency	Percentage (%)
4-23	9	4.0
24-43	68	29.8
44-63	111	48.6
64-83	38	16.7
84-103	2	0.9
Minimum age	4	
Maximum age	95	
Mean $\pm$ SD	49.80 $\pm$ 14.84	
Sex		
Male	51	22.4
Female	177	77.6

The maximum age of patients with cancer was 95 years and the minimum age was 4 years and more females (177) had cancer compared to male subjects (51). Out of the different types of cancer encountered cervical cancer was the highest 64 and the lowest was liver and gastric cancer 1.

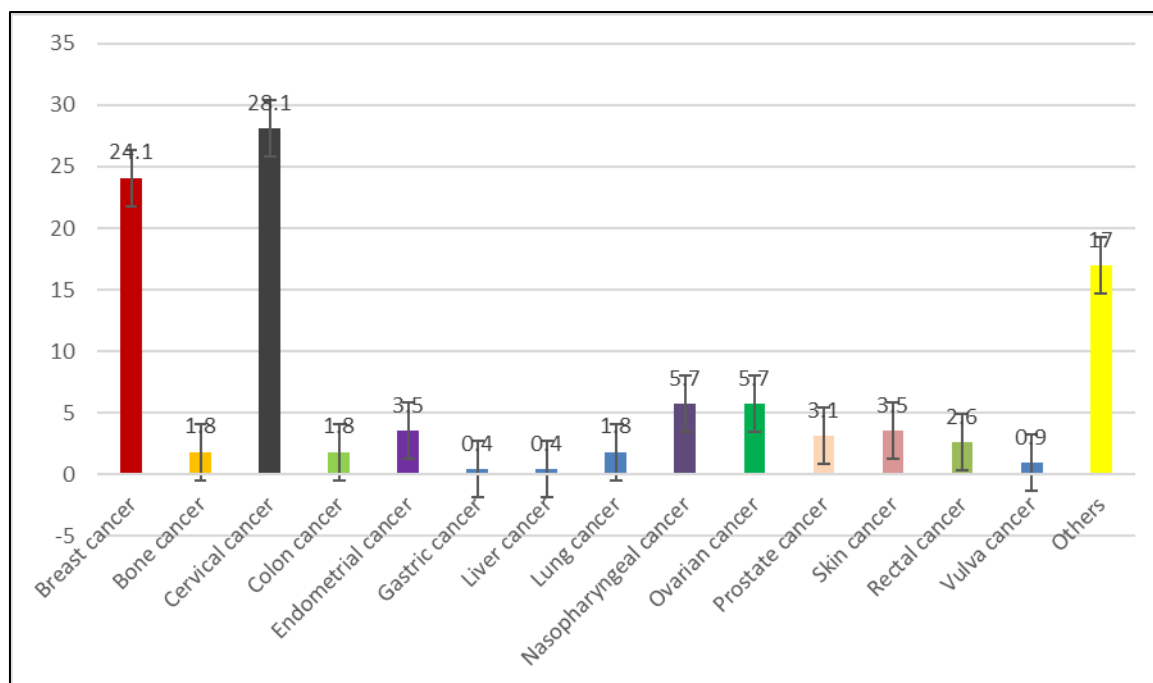


Figure 3 Percentage Distribution for Cancer Types

Out of the different types of cancer encountered cervical cancer was the highest 64 and the lowest was liver and gastric cancer 1.

Table 2 Anticancer drugs prescribing patterns in BhUTH and JUTH

Functional Classification	Drug Name	JUTH (n)	JUTH (%)	BhUTH (n)	BhUTH (%)
Alkylating agents	Cyclophosphamide	26	6.2	15	14.4
Alkylating agents	Dacarbazine	6	1.4	0	0
Alkylating agents	Ifosphamide	9	2.1	0	0
Antibiotics	Adriamycin	30	17.0	9	8.7
Antibiotics	Bleomycin	2	0.5	0	0
Antibiotics	Actinomycin	4	1.0	1	1.0
Antibiotics	Epirubicin	2	0.5	2	1.9
Antimetabolites	Capecitabine	6	1.4	3	2.9
Antimetabolites	Gemcitabine	23	5.5	0	0
Antimetabolites	5-Fluorouracil	29	6.9	11	10.6
Antimetabolites	Methotrexate	4	1.0	3	2.9
Monoclonal antibodies	Bevacizumab	1	0.2	1	1.0
Monoclonal antibodies	Rituximab	0	0	0	0
Platinum compounds	Carboplatin	44	10.5	13	12.5
Platinum compounds	Cisplatin	85	20.5	7	6.7
Platinum compounds	Oxaliplatin	4	1.0	4	3.8
Taxanes	Paclitaxel	82	19.6	15	14.4

Taxanes	Docetaxel	39	9.3	14	13.5
Topoisomerase inhibitors	Irinotecan	1	0.2	0	0
Topoisomerase inhibitors	Etoposide	9	2.1	4	3.8
Vinca alkaloids	Vincristine	6	1.4	2	1.9
Vinca alkaloids	Vinblastine	7	1.7	0	0

Table 3 Prescription pattern of adjuvant drugs in BhUTH and JUTH

Drug Class	Drug Name	BhUTH (n)	BhUTH (%)	JUTH (n)	JUTH (%)
Antiallergics	Chlorpheniramine	0	0	163	13.0
Antiemetics	Metoclopramide	60	22.6	3	0.2
Antiemetics	Granisetron	0	0	163	13.0
Antiemetics	Ondansetron	60	22.6	163	13.0
Anti-peptic ulcer drugs	Cimetidine	0	0	2	0.2
Anti-peptic ulcer drugs	Omeprazole	0	0	163	13.0
Antibiotics (non-antitumor)	Ciprofloxacin	0	0	10	0.8
Antibiotics (non-antitumor)	Ceftriaxone	3	1.1	21	1.7
Antibiotics (non-antitumor)	Levofloxacin	0	0	13	1.0
Antibiotics (non-antitumor)	Metronidazole	0	0	21	1.7
Analgesics	Cocodamol	0	0	9	0.7
Analgesics	Diclofenac	0	0	17	1.4
Analgesics	Morphine	1	0.4	8	0.6
Analgesics	Pentazocine	0	0	4	0.3
Anti-inflammatory (steroids)	Dexamethasone	60	22.6	163	13.0
Anti-inflammatory (steroids)	Hydrocortisone	60	22.6	163	13.0
Anti-inflammatory (steroids)	Prednisolone	0	0	2	0.2
Antipyretic	Paracetamol	3	1.1	9	0.7
Antiestrogen	Tamoxifen	0	0	4	0.3
Antiresorptive (bisphosphonates)	Zoledronic acid	1	0.4	9	0.7
Colony-stimulating factors	Filgrastim	2	0.8	15	1.2
Diuretics	Furosemide	7	2.6	85	6.8
Vitamins and minerals	Vitamin B complex	0	0	7	0.6
Vitamins and minerals	Vitamin C	2	0.8	10	0.8
Vitamins and minerals	Fesolate	2	0.8	9	0.7
Vitamins and minerals	Folinic acid	3	1.1	12	1.0
Others	Goserelin	1	0.4	4	0.3

Table 4a Medical cost for JUTH

Variable	Cost	Mean (SD)	Median	Range
Investigations	4159600	25057.83±15031.05	22650	121700
Surgery	2489830	155614.38±223482.55	98540	936380
Chemotherapy	122341656	732584.76±1681469.16	498340	21567020
Consultation	502500	251250±202586.1	251250	286500
Total	129493586	1164507±2122569	870780	22911600

Table 4b Medical cost for BhUTH

Variable	Cost	Mean (SD)	Median	Range
Investigations	1168500	19155.74 ± 7347.07	18000	24000
Chemotherapy	29401326.84	481988.96 ± 324152.35	463563	2058438
Consultation	95800	47900 ± 18526	47900	26200
Total	30569826.84	549044.7 ± 350025.4	529463	2108638

Table 5 Therapeutic toxicity profile of prescribed anticancer drugs

Type of cancer drugs	Side effects	Therapeutic toxicity (%)
Cisplatin	Nausea and vomiting	70-80
Cisplatin	Nephrotoxicity	25-30
Cisplatin	Ototoxicity	10-15
Cisplatin	Myelosuppression	10-15
Cyclophosphamide	Nausea and vomiting	50-70
Cyclophosphamide	Myelosuppression	30-50
Cyclophosphamide	Hemorrhagic cystitis	5-10
Cyclophosphamide	Alopecia	30-50
Doxorubicin (Adriamycin)	Myelosuppression	30-50
Doxorubicin (Adriamycin)	Cardiotoxicity	5-15
Doxorubicin (Adriamycin)	Nausea and vomiting	60-70
Doxorubicin (Adriamycin)	Alopecia	60-80
Methotrexate	Myelosuppression	20-40
Methotrexate	Mucositis	10-20
Methotrexate	Hepatotoxicity	5-10
Methotrexate	Renal toxicity	5-10
Paclitaxel	Myelosuppression	20-30
Paclitaxel	Peripheral neuropathy	10-20
Paclitaxel	Hypersensitivity reactions	5-10

Paclitaxel	Alopecia	60-80
Vincristine	Peripheral neuropathy	40-50
Vincristine	Constipation	20-30
Vincristine	Myelosuppression (Less common)	
Vincristine	Alopecia (less common)	
5-Fluorouracil (5-FU)	Myelosuppression	30-40
5-Fluorouracil (5-FU)	Diarrhea	10-20
5-Fluorouracil (5-FU)	Mucositis/Stomatitis	10-20
5-Fluorouracil (5-FU)	Hand-foot syndrome	5-10
Tamoxifen	Hot flashes	50-60
Tamoxifen	Nausea	10-20
Tamoxifen	Thromboembolic events	1-5
Tamoxifen	Endometrial changes	1-5
Rituximab	Infusion reactions	30-50
Rituximab	Myelosuppression	10-20
Rituximab	Infections	5-10
Rituximab	Hepatitis reaction in chronic carriers	

Table 6 Cancer type, therapeutic regimen and common toxicity and financial profile

Cancer Type	Therapeutic Regimen	Common Toxicities	Financial Burden
Breast cancer	Surgery (lumpectomy or mastectomy)	Myelosuppression (30–50%)	Surgery, chemotherapy, radiotherapy and supportive care. Out-of-pocket expenses and loss of income during treatment Surgery, chemotherapy, radiotherapy, and supportive care. Out-of-pocket expenses and loss of income during treatment.
Breast cancer	Chemotherapy (e.g., doxorubicin, cyclophosphamide, paclitaxel)	Nausea and vomiting (60–70%)	Same as above
Breast cancer	Hormonal therapy (e.g., tamoxifen for hormone receptor-positive cases)	Alopecia (60–80%); Cardiotoxicity with doxorubicin (5–15%)	Same as above
Cervical cancer	Surgery (hysterectomy)	Nausea and vomiting (50–70%)	Similar to breast cancer
Cervical cancer	Chemotherapy (e.g., cisplatin, 5-fluorouracil)	Myelosuppression (20–40%)	Similar to breast cancer
Cervical cancer	Radiotherapy (often with combined chemotherapy)	Fatigue (variable)	Similar to breast cancer

Prostate cancer	Surgery (prostatectomy)	Hot flashes with hormonal therapy (50–60%)	Treatment can be costly due to surgery and long-term hormonal therapy. Access to medication may be limited by financial constraints
Prostate cancer	Hormonal therapy (e.g., LHRH agonist)	Fatigue (variable)	Same as above
Prostate cancer	Chemotherapy (e.g., docetaxel in advanced cases)	Myelosuppression (20–30%)	Same as above
Lymphomas (Hodgkin's & Non-Hodgkin's)	Chemotherapy (e.g., CHOP regimen: cyclophosphamide, doxorubicin, vincristine, prednisone)	Myelosuppression (30–50%); Nausea and vomiting (60–70%); Peripheral neuropathy with vincristine (10–20%)	Similar to other cancers, cost can accumulate from multiple cycles of chemotherapy and potential hospitalization for side effects
Lymphomas (Hodgkin's & Non-Hodgkin's)	Radiotherapy (in some cases)	Fatigue (variable)	Same as above
Gastrointestinal cancers (e.g., colorectal cancer)	Surgery	Myelosuppression (20–40%)	Patients may face high cost of surgical procedures and ongoing chemotherapy, leading to financial strain
Gastrointestinal cancers (e.g., colorectal cancer)	Chemotherapy (e.g., 5-fluorouracil, oxaliplatin)	Diarrhea (10–20%); Mucositis/Stomatitis (10–20%)	Same as above

Table 7 WHO Prescribing indicators as found in JUTH and BhUTH

Prescribing Indicators	(JUTH)	(BhUTH)
Average Antibiotic Per Prescription	1.57	2.50
Average Anticancer Drug Per Prescription	2.39 (3.50%)	2.36 (28.95%)
Average Injection Per Prescription	2.45 (19.88%)	2.34 (27.72%)
Average Generics	2.11 (3.90%)	1.07 (26.32%)
Average brand	1.13 (22.13%)	1.12 (2.81%)
Average Prescription	4.23	1.11
Number of Antibiotic	1.50	1.20
Prescriptions from Essential Drug List	100%	100%

Despite the biomedical and technological advancement which have propelled the quality of cancer care and the treatment outcomes, the financial hardship experienced by the cancer patients and their family members has impacted negatively on cancer management [18], [19]. This is as a result of the inability of the patients to afford the associated cost of care required in the management of this disease condition. The economic burden thus negatively impacts the quality of care accessible to the patients and the eventual treatment outcomes and the quality of life of the patients. The financial burden is even worse in resource limited countries such as Nigeria where the majority of the people live on less than a dollar per day [20]. Cancer disease is a leading cause of death globally. It is characterized by continuous, uncontrolled multiplication of the cells of the body. The factors associated with the development of the disease are varied and they can be from environmental, dietary, lifestyle or radiation sources [21], [22]. The management of cancer has a heavy cost implication [23]. Chemotherapy is a key component required in the management and treatment of cancers [24]. Over the years, medications that brings about better treatment outcomes are being produced by the pharmaceutical industries. The medications are expensive and beyond the reach of the poor. The low-income countries

are particularly challenged in the management of cancer as a result of financial constraints both at individual and governmental levels [25]. In this study, breast cancer (24%) and cervical cancer (28%) were the most common type of cancer found in the community under study. This is similar to the findings in a recent study that showed that breast cancer is the most common type of cancer [26]. The age bracket most affected by cancer plague is between 44-63 years of age. However, a recent study showed that there is no correlation between ageing and development of cancer disease [27]. The development of cancer has more to do with exposure to the predisposing factors than advancement in the age of an individual. The anticancer drugs mostly in use at the public hospital, JUTH and the faith based or private hospitals are the antimetabolites, the taxanes, alkylating agents and the platinum compounds. However, in another study, the most prescribed anticancer drugs were cisplatin, etoposide and cyclophosphamide [10]. It is noteworthy that new generation of anticancer drugs are available especially in the developed countries. The average cost for the treatment of cancer in a public hospital, JUTH is N1164507±2122569 or \$1000 while the average cost of the same care in a mission-based hospital BhUTH is N549044.7±350025.4 or \$460. This shows that treatment cost in a public hospital is significantly higher than in a missionary-based hospital or private hospital. On the contrary, a recent study showed that the treatment cost of cancer in a private hospital is significantly higher than in a public health institution or hospital [28]. Lack of affordability of the medicines will ultimately lead to abandonment of the treatment options and eventual poor outcome [29]. This study reveals the dual burden of therapeutic and financial toxicity among cancer patients in Nigerian tertiary health facilities. The findings highlight critical issues in oncology care in low-resource settings, where patients often contend with severe side effects from conventional chemotherapeutic agents alongside unsustainable treatment costs. Cervical and breast cancers, both prevalent in women, were the most commonly treated cancers in the cohort, aligning with national and global cancer epidemiology trends. The reliance on older cytotoxic agents—such as cisplatin, cyclophosphamide, and doxorubicin—though effective, is associated with high rates of adverse effects like myelosuppression, nausea, alopecia, and organ toxicity. These toxicities, especially when unmanaged, contribute to poor adherence, compromised quality of life, and increased hospitalization.

Financial toxicity was equally alarming. Chemotherapy was the costliest component, with some regimens exceeding ₦2 million, especially in JUTH. Direct medical costs (investigations, surgery, and consultations) and indirect costs (lost income, transportation) further compound the burden. Patients at both institutions largely paid out-of-pocket, with negligible insurance support. This finding echoes other studies in sub-Saharan Africa where catastrophic health expenditures for cancer care are common and lead to treatment abandonment or delayed initiation.

The WHO prescribing indicators showed concerning levels of polypharmacy and underuse of generic medications. In BhUTH, the use of generics was notably low (26.32%), potentially driving up treatment costs. The predominance of brand-name prescriptions, despite economic constraints, calls for improved drug procurement policies and adherence to essential medicine lists.

Ultimately, the study emphasizes the need for systemic changes: subsidies for essential cancer treatments, expanded insurance coverage, and integration of less toxic and targeted therapies where feasible. Strategic interventions, including patient education and health system strengthening, are essential to mitigate the burdens identified and improve cancer care outcomes.

4. Conclusion

Cancer treatment in the studied institutions is characterized by substantial therapeutic and financial toxicity. This suggests the level of burden associated with accessing cancer management in public, private/faith-based health facilities in Nigeria where generality of the members of the society live on less than a dollar per day. The need for affordable care, improved insurance coverage, and safer therapeutic options is critical to enhance cancer care outcomes in resource-limited setting.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

The Authors declare no conflict of interest of any sort.

Statement of ethical approval

Ethical clearance with ref no. JUTH/DCS/IREC/127/XXX/455 was obtained from the ethical committee of the Jos University Teaching Hospital and a letter of permission to access patient folders was also obtained also from the Head of Department of Oncology unit.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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